

Title: Simulated Space Environmental Effects on Thin Film Solar Array Components

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Abstract:

The Lightweight Integrated Solar Array and Transceiver (LISA-T) experiment consists of thin-film, low mass, low volume solar panels. Given the variety of thin solar cells and cover materials and the lack of environmental protection afforded by typical thick coverglasses, a series of tests were conducted in Marshall Space Flight Center's Space Environmental Effects Facility to evaluate the performance of these materials. Candidate thin polymeric films and nitinol wires used for deployment were also exposed. Simulated space environment exposures were selected based on SSP 30425 rev. B, "Space Station Program Natural Environment Definition for Design" or AIAA Standard S-111A-2014, "Qualification and Quality Requirements for Space Solar Cells." One set of candidate materials were exposed to 5 eV atomic oxygen and concurrent vacuum ultraviolet (VUV) radiation for low Earth orbit simulation. A second set of materials were exposed to 1 MeV electrons. A third set of samples were exposed to 50, 500, and 750 keV energy protons, and a fourth set were exposed to >2,000 hours of ultraviolet radiation. A final set was rapidly thermal cycled between -50 and +120°C.

This test series provides data on enhanced power generation, particularly for small satellites with reduced mass and volume resources. Performance versus mass and cost per Watt is discussed.